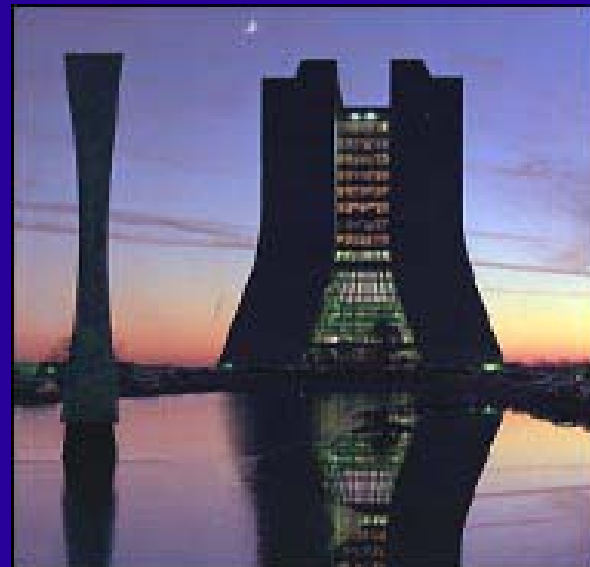




CMS Computing at FNAL

Hans Wenzel Fermilab

- / Introduction
- / CMS: What's on the floor, How we got there.
- / Near term plans.





Introduction

- / CMS is an experiment in construction for the LHC, first data expected in 2006
- / Until then computing at FNAL provides:
- / Monte Carlo Production (Trigger + physics TDR) in distributed environment.
- / Host and serve the data
- / Provide computing and development platform for physicist (code, disk



Our Web sites

/ Monitoring page, links to tools and scripts

http://computing.fnal.gov/cms/Monitor/cms_production.html

/ **Department web site:** <http://computing.fnal.gov/cms>

The CMS dpartment

" New department, most people hired over the last 18month

"Same is true for the hardware I will give an historical overview



+ the desktop PC's:

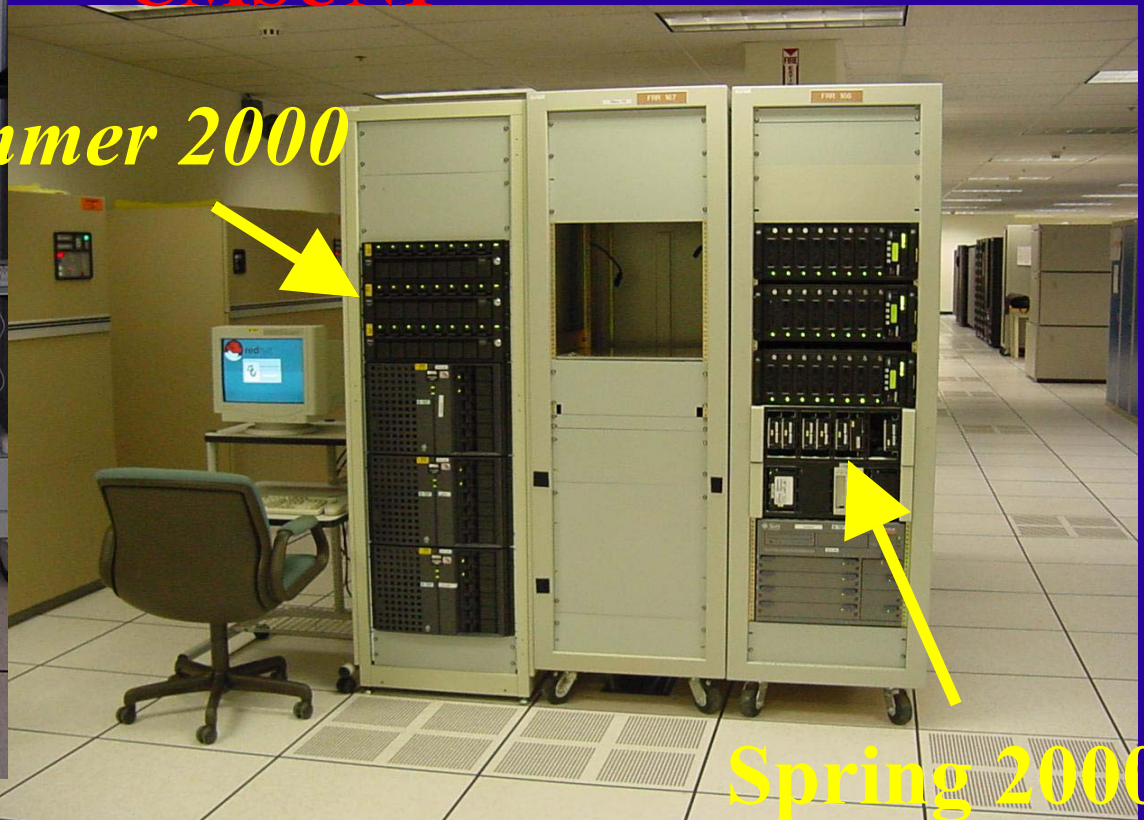
Fall 2000



SERVERS:

GALLO, WONDER, VELVEETA,
CMSUN1

Summer 2000



Spring 2000

Popcrn01 - popcrn40



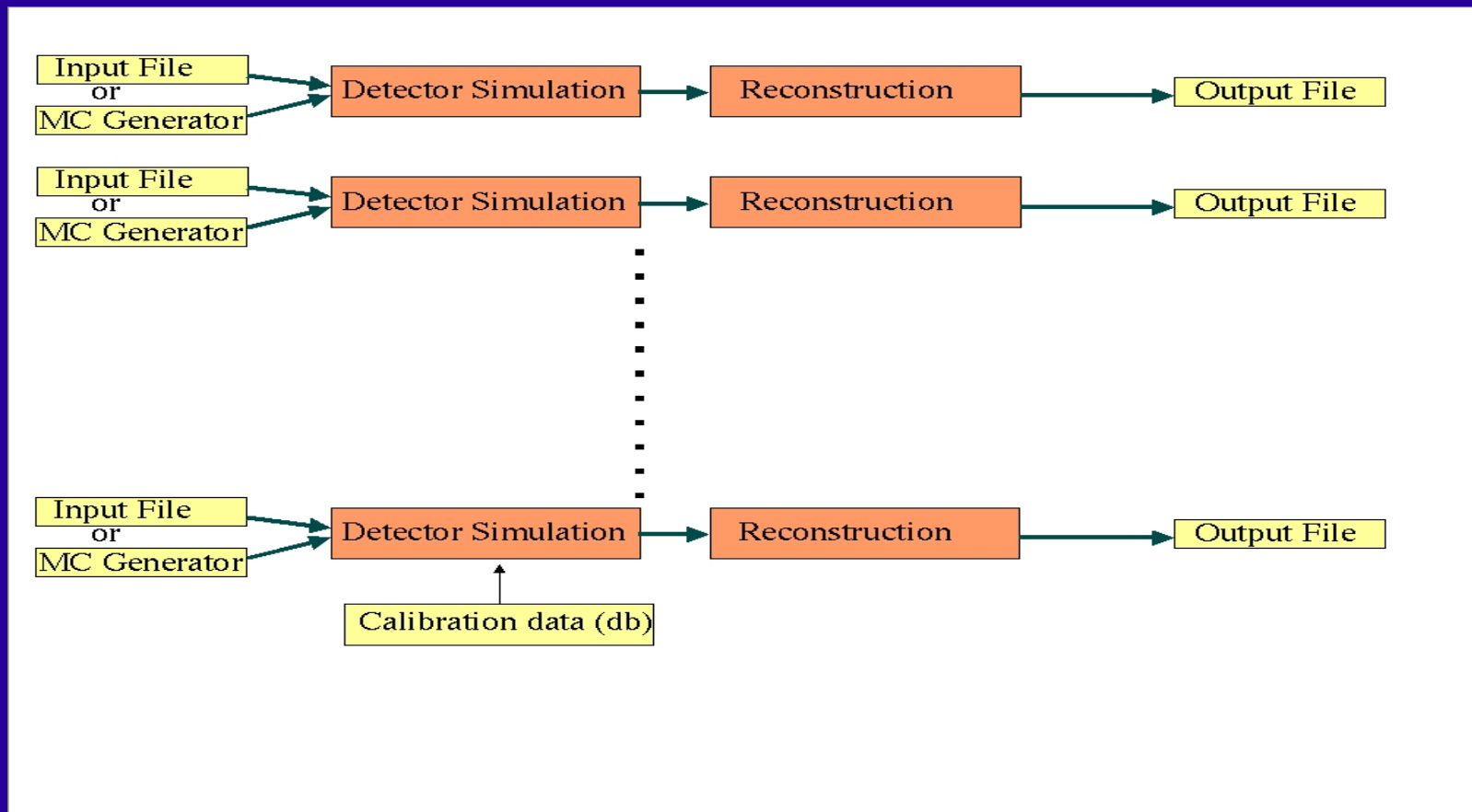
Hardware and software used in Production

- / 2 Dell Servers with 4 Pentium CPU's. GALLO is the IO node of the FARM and VELVEETA is the Objectivity Database host. Each has > 200 Gbyte raid attached.**
- / 40 dual CPU (popcrn01-popcrn40). For Digis production 10 are used as pile up server leaving the other 30 (60 CPU's) as worker nodes. Currently we have a sample of 500 000 minimum bias events.**
- / STK robot (enstore)--> tapes are made by the devil (pure evil)**
- / FBSNG batch system --> can only recommend**



Think about production!

Classic way:



easy to do: linux farm with batch system,
very robust the processes don't care about each other, if the node
or the process dies you run it again!



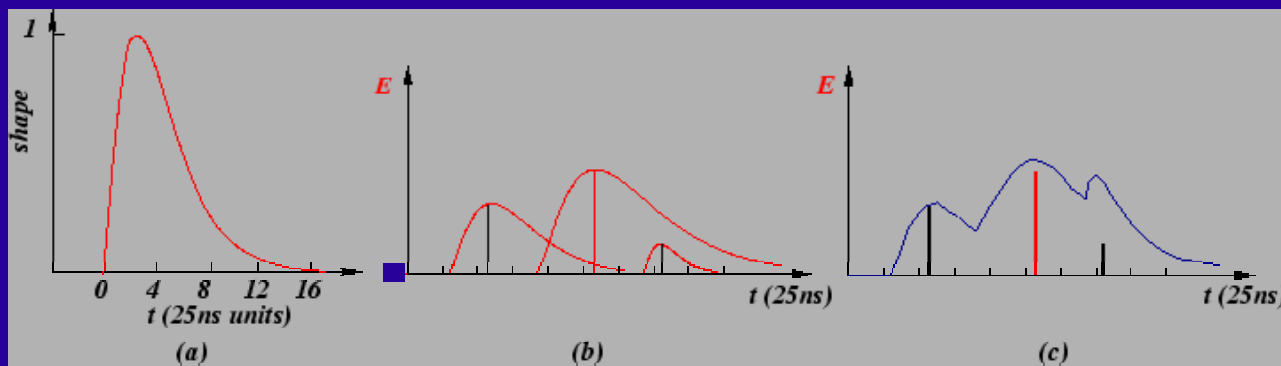
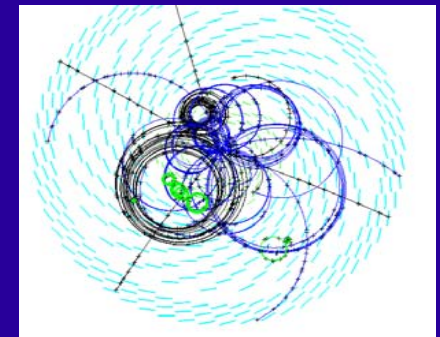
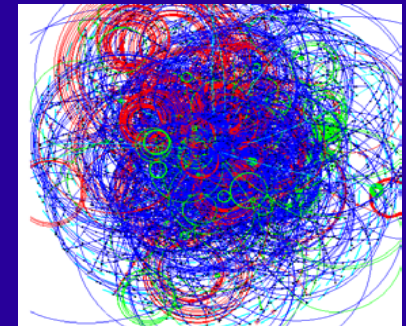
CMS Major Challenge: Pile up

- " **Events are big (raw event is 2MB)**
- " **Detector digitization has to take into account multiple crossings**
 - 1 **Pileup: @ 10^{34} = 17 minimum bias events/crossing**
 - 1 **Calorimetry needs -5 to +3 crossings**
 - 1 **Muon DT ought to have +/- 10 crossings**
 - 1 **Tracker loopers can persist for many crossings**
 - 1 **Typically need information from ~ 200 mb events for each signal event**
- " **Study at different luminosities infers different pileup**
 - 1 **Therefore not sensible to include pileup in simulation but in digitization (front end of reconstruction)**
- " **Track finding in very complex environment**
- " **High magnetic field and ~ 1 rad length of tracker material:**
 - 1 **Lots of bremsstrahlung for the electrons,**
 - 1 **TK-ECAL matching non-trivial**



Digitisation and Pileup

- " High luminosity \rightarrow 17 minimum bias events in one bunchcrossing
- " Overlay crossings -5 to +3
- " 200 min.bias for 1 signal event
- " "recycle" min.bias events





Pileup

- Solution is to sample a finite number pseudo-randomly
- Problems can come when one single mb event by itself would trigger the detector
 - ➔ You would get this trigger many many times
 - ➔ Filter the minimum bias events, but remember to take into account the removed events
 - ➔ must sample from full range of mb events to ensure patterns do not repeat too often
- If you need 1 Million Signal events you would need 200 million minimum bias events
 - ➔ Impossible with current CPU, storage etc
- 200mb events = 70MB
 - ➔ massive data movement problem



OODigis

Currently

OOHit Data

GALLO

VELVEETA

Pile up

Popcr31

Popcrn32

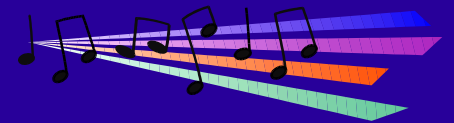
Popcrn01

Popcrn40

Popcrn30

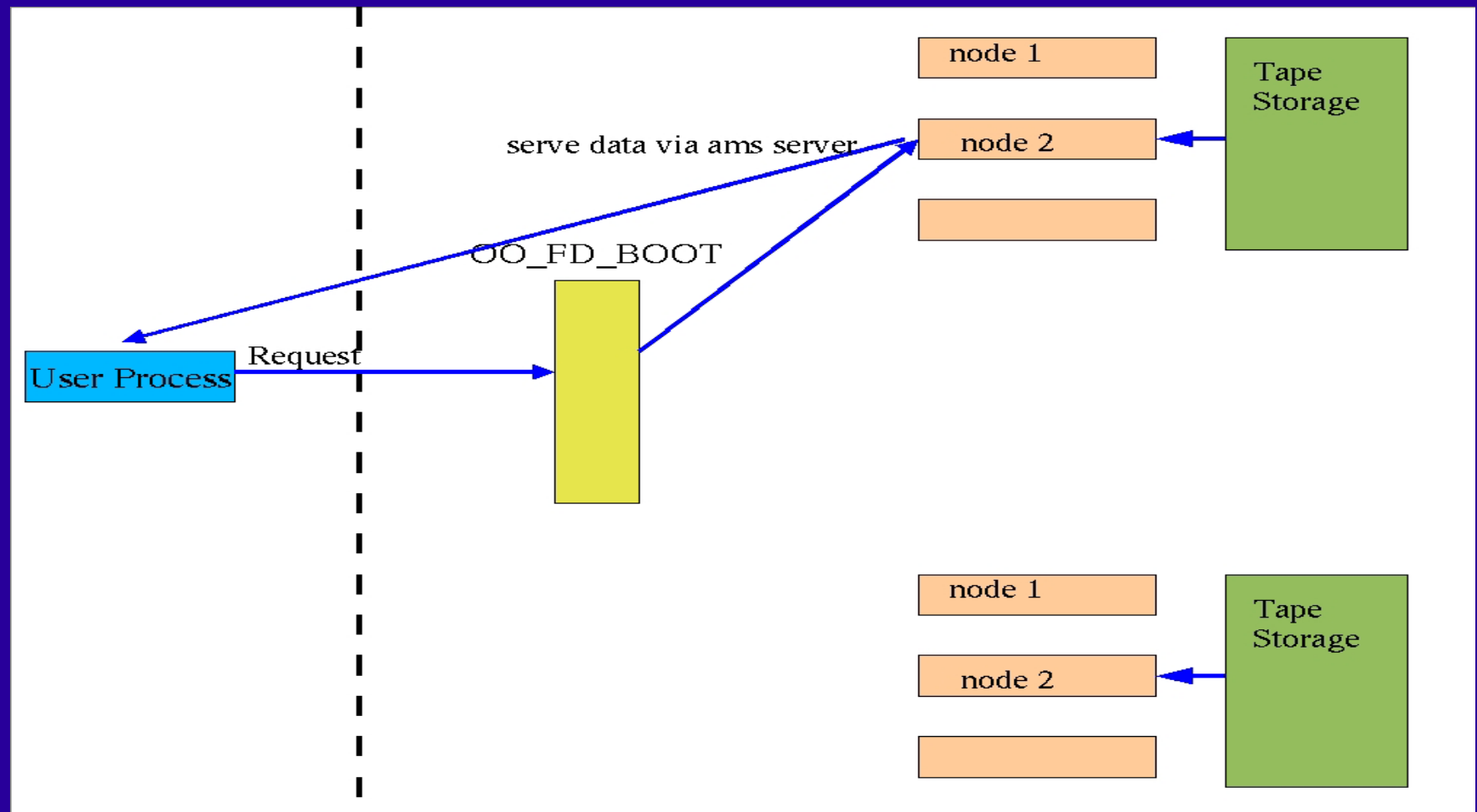
AMS Servers on
popcrn31-popcrn40
(pile up servers)
GALLO (data server)
VELVEETA (DB host)

Every one talks to everyone



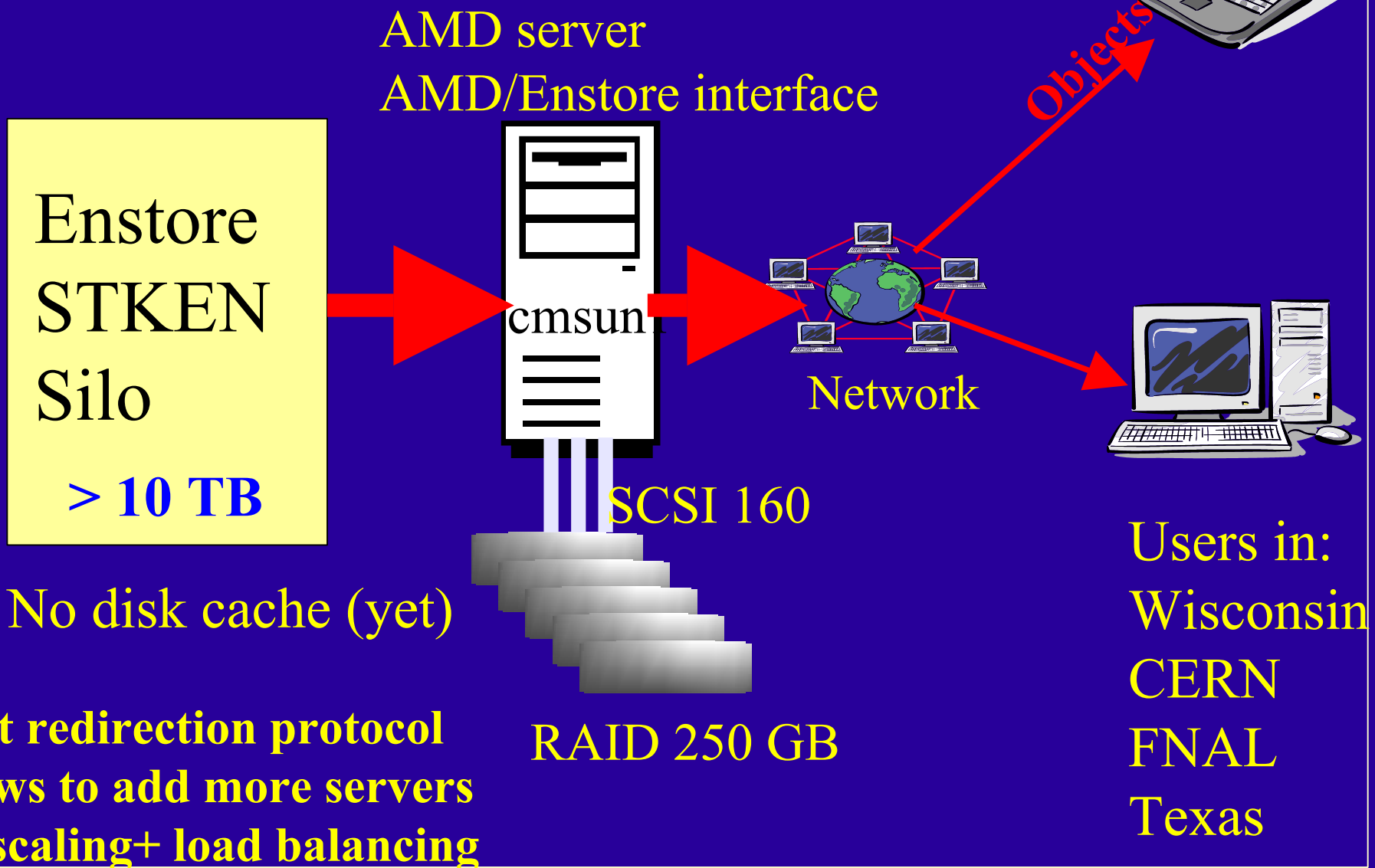


User access to the data in Objectivity





User access to FNAL Objectivity data:



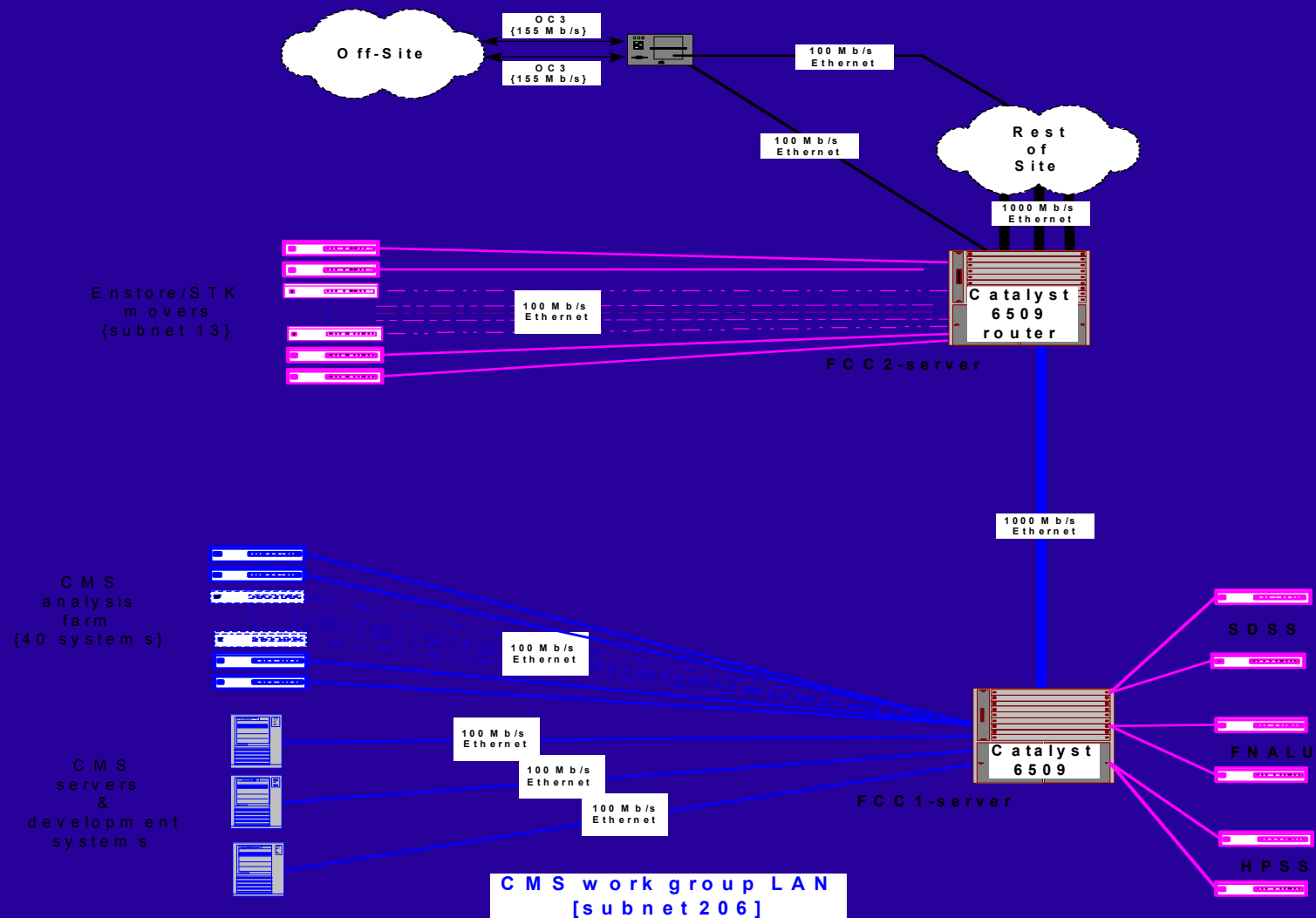
**Host redirection protocol
allows to add more servers
--> scaling+ load balancing**



Upgrades in 2001



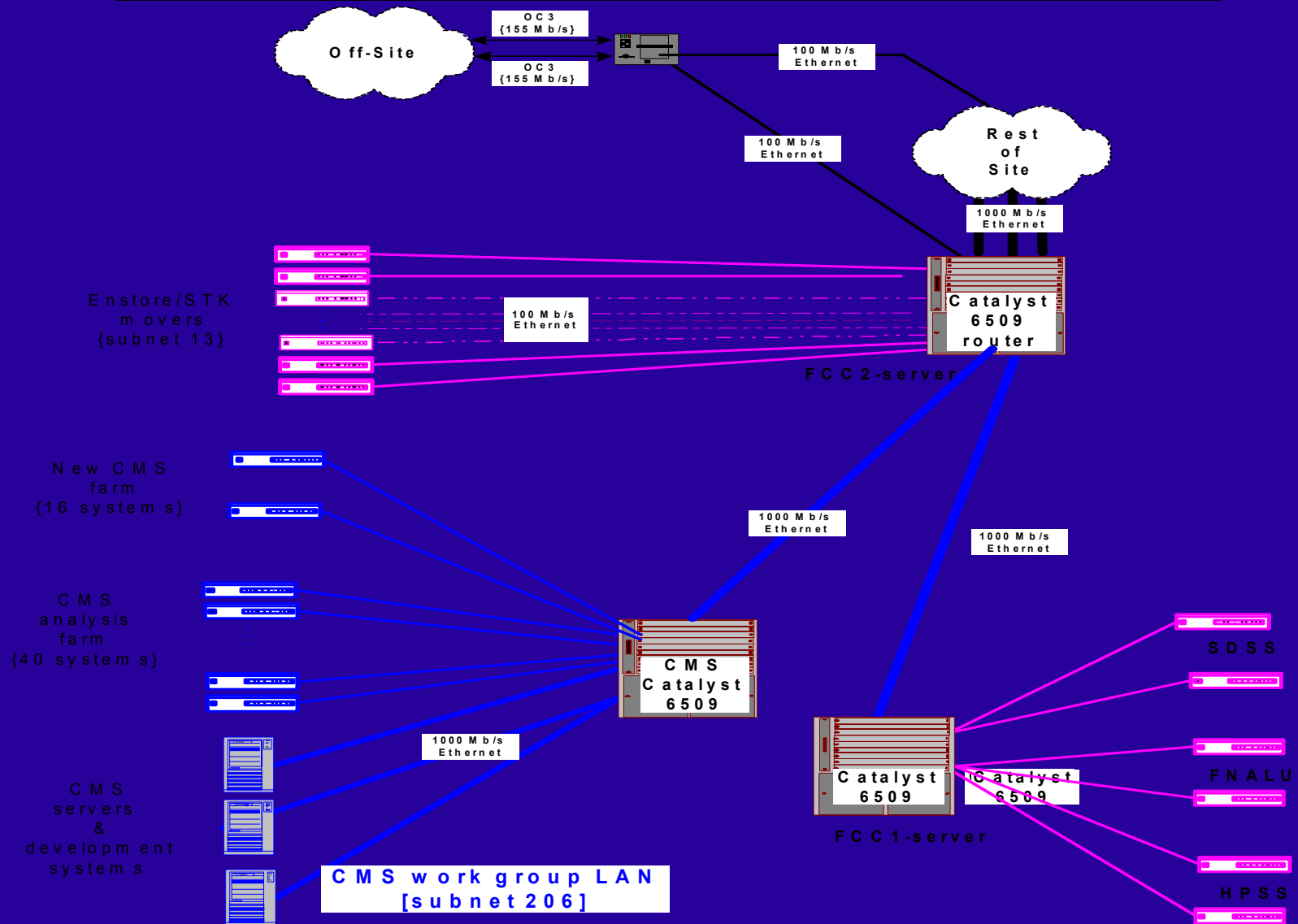
Current Networking



pjd
1/5/01

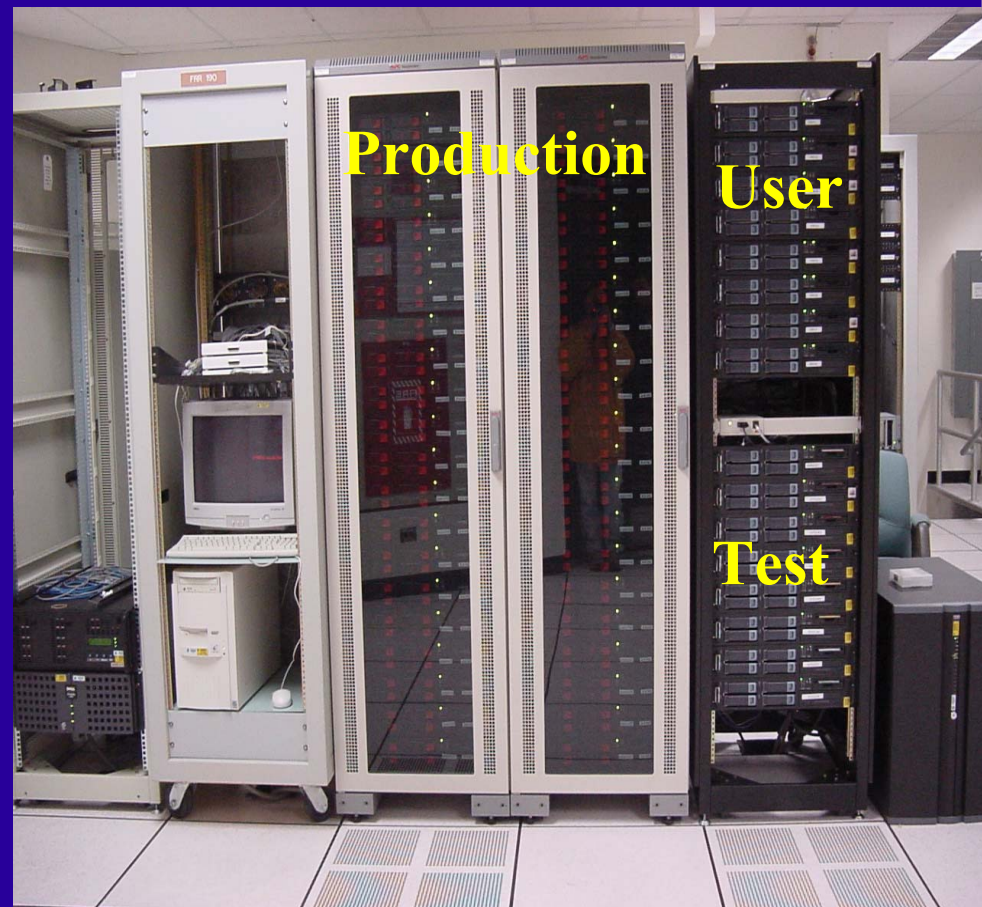


Upgraded Networking





Fall 2001





Near term plan

- / Testing and benchmarking of raid arrays
- / Build up a User analysis cluster:
 - load balancing
 - cheap
 - expendable
 - easy central login
 - transparent access to disks
 - make plenty of local disks globally available.....



Proposed CMS User Cluster

OS: Mosix?

Fbsng batch system?

Disk farm?

